Application: 0000000464

April Thompson - athompson@lakeview-academy.com
Classroom Grant

Summary

ID: 0000000464
Last submitted: Apr 19 2022 04:25 PM (MDT)

Classroom Grant Application

Completed - Sep 23 2021

Classroom Grant Application

If you have any questions please call the Kellie at the STEM Action Center at 435-757-9595 or email at kellieyates@utah.gov .

*** Are you a teacher or an administrator?**

Teacher

*** Are you from a district or a charter school?**

Charter School

What is the name of your school or out-of-school program?

(No response)

*** Please specify the name of your charter school:**

Lakeview Academy

Have you been awarded a STEM Classroom Grant in the past three (3) school years?

Yes

Do you teach students that live in a rural community?

No

STEM PROJECT DETAILS

*** Which STEM subject will you integrate with your project?**

Responses Selected:

Science
Technology
Engineering
Math

*** How many students will this project impact in the current school year?**

100

*** Which grade(s) is this project intended for?**

9th grade

*** Please give a complete description of this project.**

Students will begin this unit by exploring the idea of osmosis and diffusion and the role of cell membranes. Students will create a model cell to observe diffusion through a membrane. Questions students will consider: What molecules can pass through the pores of a cell membrane? How does osmosis (diffusion of water) affect plant and animal cells placed in different environments? Students will predict what molecules might pass through the cell model membrane. Students will perform lab tests to determine if there predictions are correct and explain how diffusion and osmosis can be applied to real-world scenarios.

We will continue the unit considering the idea by using the real world scenarios that all of us have felt sick at some point in our lives. Many times, we find ourselves asking, "What is the quickest way that I can start to feel better?" To start this unit, students study that question and determine which form of medicine delivery (pill, liquid, injection/shot) offers the fastest relief, and how this relates to their learning around osmosis and diffusion. This challenge question serves as a real-world context for learning all about flow rates and integrating mathematical and computational thinking as well as conducting investigations and analyzing data. Students will study how long various prescription methods take to introduce chemicals into our blood streams, as well as use flow rate to determine how increasing a person's heart rate can theoretically make medicines work more quickly. Students will then move into the engineering part of the unit by engineering devices that simulate what occurs during the distribution of antibiotic cells in the body.

Once students understand antibiotics, I want to bring in a real-world problem I see adversely affecting my students. I want to apply this idea to vaping. Students will consider the question: Does vaping expose you to harmful chemicals? Investigate whether vaping e-cigarettes exposes users to toxic chemicals, such as those found in traditional cigarettes. Students will conduct simulated urine tests for four toxic chemicals found in cigarette smoke. Students will analyze data from research that tested urine samples from teens for four toxic chemicals. Students will also analyze information to determine the danger of respiratory damage associated with vaping the four chemicals. Students will then communicate information about e-cigarettes and actions that can be taken to reduce the health risks posed by vaping.

We will end this unit by looking at the problem of drug overdose. Acetaminophen is a pain reliever found in many over-the-the counter medicines and some prescription medicines. Acetaminophen overdose can cause liver damage leading to serious illness or death because the liver carries out many functions critical for maintaining homeostasis. Students will follow the case of a teen with symptoms of liver damage. Students will conduct simulated laboratory tests. Students will analyze the medicines the teen took to determine if his symptoms are caused by a dangerous acetaminophen overdose.

We will end the unit with an engineering design challenge. Using what they have learned through all the other labs and activities, students are challenged to think as biomedical engineers and brainstorm ways to administer medication to a patient who is unable to swallow. They will learn research the advantages and disadvantages of current drug delivery methods such as oral, injection, topical, inhalation and suppository. They will all consider pharmaceutical design considerations, including toxicity, efficacy, size, solubility/bioavailability and drug release duration. Students will then create and test large-size drug encapsulation prototypes to provide the desired delayed release and duration timing.

*** Please include any website links that are specific to your request as a reference.**

https://www.teachengineering.org/curricularunits/view/van_feelbetter_curricularunit;
https://www.sciencetakeout.com/

*** How will your students benefit from this STEM activity?**

I want students to see the connection and apply their learning to real-world situations they are facing. I believe this is what excites and empowers students to truly value their education and become lifelong learners. I don't want my students to see science or STEM as a subject, but as a tool for solving real-world problems. I want them to see how scientists, engineers, and mathematicians use the things they learned in school to change the world and solve problems. I want it to be a more personal and intimate problem. One that is actually affecting them and their peers right now in their lives. Hopefully with more education they can make better choices.

*** Which Content Standard(s) does this project support?**

These standards should reference the state content standards as designated by the Utah State Board of Education. Include the actual title for each standard, such as "Math: RP 7.2.2"

Common Core Math Standards:
Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. (Grades 9 - 12)

Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (Grades 9 - 12)

International Technology Standards:

Throughout history, new technologies have resulted from the demands, values, and interests of individuals, businesses, industries, and societies. (Grades 6 - 8)

Established design principles are used to evaluate existing designs, to collect data, and to guide the design process. (Grades 9 - 12)

NGSS Standard:

HS-ETS1-1. Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants. (Grades 9 - 12)

Utah SEEd Standards:

Plan and carry out an investigation to determine how cells maintain stability within a range of changing conditions by the transport of materials across the cell membrane. Emphasize that large and small particles can pass through the cell membrane to maintain homeostasis. (LS1.A)

Standard BIO.2.6

Ask questions to develop an argument for how the structure and function of interacting organs and organ systems, that make up multicellular organisms, contribute to homeostasis within the organism. Emphasize the interactions of organs and organ systems with the immune, endocrine, and nervous systems. (LS1.A)

Standard BIO.2.7

Plan and carry out an investigation to provide evidence of homeostasis and that feedback mechanisms maintain stability in organisms. Examples of investigations could include heart rate response to changes in activity, stomata response to changes in moisture or temperature, or root development in response to variations in water level. (LS1.A)

Standard BIO.3.5

Evaluate design solutions where biotechnology was used to identify and/or modify genes in order to solve (effect) a problem. Define the problem, identify criteria and constraints, analyze available data on proposed solutions, and determine an optimal solution. Emphasize arguments that focus on how effective the solution was at meeting the desired outcome. (LS3.B, ETS1.A, ETS1.B, ETS1.C)

*** How does this project take a creative approach to extend what you normally do in the classroom?**

This is creative, because I am creating a whole new unit. I am writing new curriculum and bring more engineering and real-world issues into my classroom. I have never allowed students to dive into these topics or ideas before. I feel they are important to address and that students will be engaged and empowered by solving and understanding situations close to home. I also don't feel like students see the connection between math, science, technology, and engineering. I want them to see how these disciplines work together to improve quality of life and define and evaluate problems that exist in our world.

*** How is this project sustainable over several years?**

This project is sustainable. After writing the unit and creating the curriculum, it will require a few consumables year after year but my classroom funds will cover the cost to order those. My principal was also very supportive of this idea and this topic. He told me if I could get the curriculum written and the items in place from the grant. He would support funding it again.

*** What additional funding support are you receiving to be able to implement this program?**

I have not secured additional funding from other sources. I do have$200.00 in classroom funds that I have saved to help cover items that come up as I continue putting this all together.

*** How will you measure the outcomes of this project related to student learning? Please be specific in your measurement tools, which should include more than summative assessment(s).**

This unit will include many types of formative and summative assessments as well as creating and revising prototypes using the engineering design process.

For example:

1. Students make large-scale models of microfluidic devices using a bonding process similar to that used in the creation of lab-on-a-chip devices. They use disposable foam plates, bendable plastic straws, tape and JELL-O mix.
2. Students will have investigations they will record in their interactive notebooks on gummy bears, vaping, flow rate, drug overdose, and designing a capsule. I will grade their notebooks and look for understanding and student learning by reviewing answers to phenomenon and discussion questions.
3. Students will complete flow rate problems.
4. Student team will research delivery methods to find out their speeds, most suitable applications and why. (Examples: Pumps used for insulin, inhalers for asthma medications, implants for anticancer and pain medications, patches for estrogen replacement and smoking cessation treatments, and the covering of stents with the blood thinner heparin.) For advanced learners I can include the question: Does it matter at what time of day or whether oral medications are best taken with food or on empty stomachs?
5. Students follow the steps of the engineering design process as they make large-size shell encapsulation prototypes for oral drug delivery using household materials. Student teams will have three design/test iterations, aiming to achieve solutions that meet the drug release delay and duration requirements.
6. Formative Assessment at the end of the unit .

*** Please outline the schedule for this project, including planning and prep.**

I plan to start this unit in January, so that I have the next few months to create powerpoints, lab sheets, google forms, and the equipment and supplies needed to facilitate the investigations. I also need time to practice doing what the kids would be doing by making my own models and prototypes and seeing what I learn from that process. I was not an engineer in school, so I need to practice myself so I can effectively mentor students through these activities.

Day 1: Introduction to homeostasis and the cell membrane (Powerpoint, notes, and create a model)
Day 2: Gummy Bear Investigation - students will plan an carry out an investigation based on information

on Day one on how to grow the biggest gummy bear. Students will be able to use distilled water, salt and sugar. They will determine the concentrations.

Day 3: Students will use supplies provided to create a model cell and discover that small molecules, but not large molecules, can diffuse through the cell membrane. They will use that model to explore the effect of osmosis on plant cells and animal cells.

Day 4: Information on difference between smoking and vaping and how substances from smoke cross the cell membrane. (Powerpoint and notes)

Day 5: Students will carry out an investigation to determine whether vaping e-cigarettes exposes users to toxic chemicals, such as those found in traditional cigarettes.

Day 6: Students will communicate information about e-cigarettes and actions that can be taken to reduce the health risks posed by vaping to other students in the school through i-movie commercials, video trailers, powerpoints, or posters.

Day 7: A history of antibiotics and how they work to destroy bacteria (Powerpoint, notes, and game)

Day 8: Guide students to think about how medicine “flows” through

the body. What would we need to learn about the flow? Discuss how medicine gets into the blood stream. Conduct a short class demo on how long it takes for three types of pills to dissolve in the stomach. What does this imply about those in liquid form? What happens when you receive a shot? Students should now be able to determine what form of medicine to take (the shot).

Day 9 - Introduce the concept of microfluidic devices and their uses. Students will create their own large-scale model microfluidic devices using JELL-O. Models will need to set-up over night.

Day 10 - Students inject their devices with colored liquid and watch a short microfluidics video clip. What do they now notice about the particles? What is the most effective flow rate (slow, medium, fast)? Conclude with a classroom discussion on what students think they could do to get medicine to work more quickly. Guide them to think about trying to move the cells more quickly through the body and remind them about the ideas of osmosis, diffusion, and homeostasis. In terms of the microfluidics device, what is happening as the size of the channel changes?

Day 11: Introduce flow rate, and its basic equation. Solve several example flow rate problems. How would flow rate pertain to taking medicine? For mathematical component, students will solve flow rate problems provided on a worksheet.

Day 12: Drug overdose - Putting ideas of flow rate, homeostasis and transport students will solve "The Case of the Unintentional Overdose." Students will use a lab kit to consider how Acetaminophen, a pain reliever found in many over-the-the counter (OTC) medicines and some prescription medicines can be overdosed and cause damage to the liver, affecting the homeostasis of the body.

Day 13 - This lesson will cover the five types of pharmaceutical administration: 1) oral, 2) injection, 3) topical, 4) inhalation and 5) suppository.

Day 14 - Students follow the steps of the engineering design process as they make large-size shell encapsulation prototypes for oral drug delivery using household materials. Teams each encapsulate a Wiffle® ball containing colored drink mix powder, which represents a porous shell containing a new miracle drug. They submerge their prototypes into buckets of water for timing tests. Teams go through at least three design/test iterations, aiming to achieve solutions that meet the drug release delay and duration requirements.

PROJECT BUDGET INFORMATION

PROJECT BUDGET INFORMATION

Enter information about your project budget. Please include ALL expenses, including shipping and handling. We are unable to pay for sales tax with these grant dollars. DO NOT INCLUDE ESTIMATIONS. Awards are based on the exact cost of the project. Amount of funding cannot be increased once awarded. NOTE: STEM AC RESERVES THE RIGHT TO FUND YOUR REQUEST AT A LOWER AMOUNT. THe MAXIMUM request amount is $1500.00

	Item name	Cost
	Gummy Bears	5.93
	9 oz Plastic Cups	10.64
	Osmosis Kit	259.56
	Vaping Kit	240.00
	Drug Overdose Kit	324.45
	Straws	29.70
	Aluminum Pie Plates	65.34
	Jello	125.00
	Kool-aid	10.00
	Wiffle Ball	87.84
	Syringe	109.90
	Shipping	80.00
	Styrofoam Plate	15.99

	Vinegar	2.72
	Shop Towels	25.12
	Dish Packing Foam	22.44
	Weed Barrier	19.94
	Saran Wrap	8.94
	Duct Tape	20.54
	5 gallon buckets	25.00
Total		1489.02

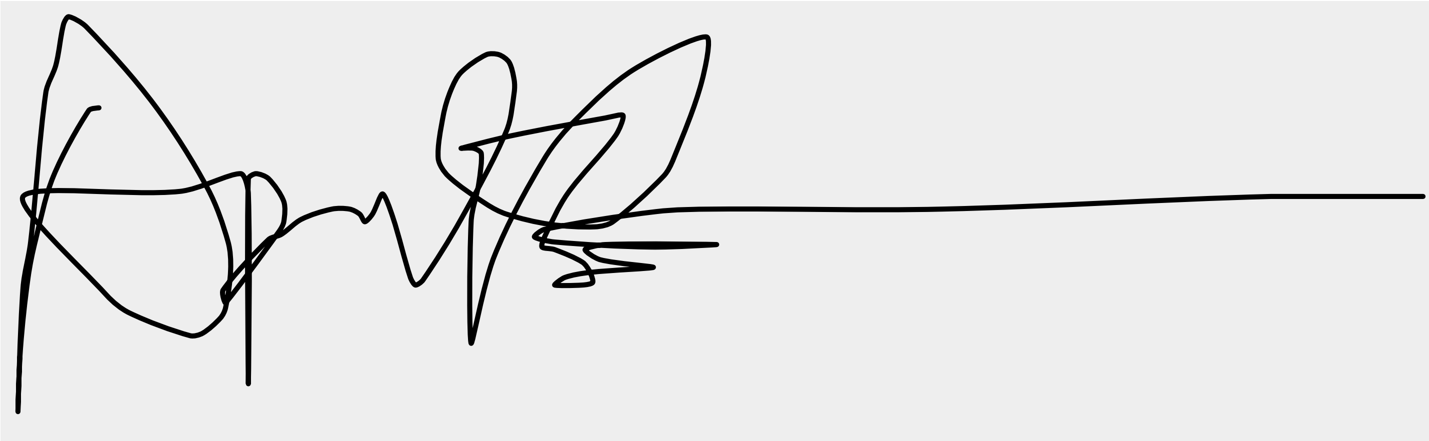
**** The STEM Action Center office reserves the right to award funds equal to or less than the applicant's request. If awarded, recipients will need to sign a contract agreeing to all reporting requirements, which include submitting receipts, photo or video documentation of the funded learning experience, and a short project completion report (template provided).**

APPLICATION AGREEMENT DETAILS:

The signatures below indicate the agreement between the STEM Action Center and School or District to engage in all the terms and conditions described in the application. All parties believe that the responsibilities and efforts as described previously reflect reasonable judgments as to what will be involved in efficient and effective conduct of the research. By signing this application, applicant ensures all information is complete and accurate.

The application will be considered incomplete until all signatures are received.

*** APPLICANT SIGNATURE:**



*** School, Program or LEA ADMINISTRATOR SIGNATURE:**

Please check with your school leadership to determine whose signature you need. Several districts, including (but not limited to) Jordan District, need to provide district level acknowledgement of grant applications.